DOCUMENT RESUME

ED 048 350 TM 000 426

AUTHOR Biggs, J. B.
TITLE Effects of Study Behavior on Objective-Style and Essay-Style Performance.
PUB DATE Feb 71
NOTE 50p.; Paper presented at the Annual Meeting of the American Educational Research Association, New York, New York, February 4-7, 1971

EDRS PRICE EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS Behavior Patterns, College Students, Convergent Thinking, Educational Testing, *Essay Tests, Evaluation Techniques, Factor Structure, Motivation, *Objective Tests, *Student Evaluation, *Study Habits, *Study Skills, Test Interpretation, Test Selection, Values

ABSTRACT

In this study, the effects of motivational and behavioral dimensions of study behavior on objective and essay modes of evaluating course content were investigated. Several performance measures in two undergraduate Educational Psychology courses were factor analyzed, and three orthogonal performance factors were obtained: general achievement, objective-style, and essay-style. Value-motivational and strategic aspects of study behavior were assessed by a questionnaire. Multivariate analyses of variance were carried out using the study behavior dimensions as the independent and the performance factor scores as the dependent variables. High achievement was found to be related, independently of mode of assessment, to two kinds of study strategy, reproductive and transformational, and the appropriateness of each depended on the student's value-motivational orientation to his course work. Converging-type strategies were related to objective performance, and several marker/student characteristics to essay performance. Some implications for teaching, evaluating, and study efficiency were noted. (Author)

ED 048350

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

Effects of Study Behavior on Objective-Style and Essay-Style Performance

by

J. B. Biggs

Department of Educational Psychology,
University of Alberta.

TM 000 426

Prepared for presentation at the Annual Meeting -
American Educational Research Association
New York, 1971.

Effects of Study Behavior on Objective-Style And Essay-Style Performance

J. B. Biggs

University of Alberta

It has become a fairly common practice at university to use both objective tests and essays to evaluate student progress. Either method can be criticized, but it would be generally believed that their relative strengths and weaknesses are complementary -- objective tests gain in reliability but lose by virtue of an assumed focus on trivial content, while essays gain in that they tap more "significant" content but lose on reliability. The fairest option thus appears to be that both methods should be used.

Andrews (1968) refers to the dual functions of methods of evaluation; teaching and testing. While quantitative estimates of reliability and validity are important in assessing the testing function of an evaluative technique, they are not so relevant for the teaching function. If a teacher believes it useful on educational grounds that a student express himself in continuous prose, Andrews argues that this is sufficient justification to retain the essay, whatever the reliability of the essay mark. But for evaluative purposes the instructor still needs to know how much weight, if any, he should give the essay and the objective test with respect to final grades.

Surprisingly, there has been very little research on this question of relative weight (Gustav, 1968; Andrews, 1968). Gustav intercorrelated two essay ratings and two objective tests with each other and with final grade in several sections of an introductory psychology class involving 600 students.

The objective tests intercorrelated more highly with each other (.64) than did the essays (.38) and also had higher correlations with the final grade (.73) than did the essays (.58). Andrews found that the objective tests in her sample (6 undergraduate psychology classes of 30 students each) were more internally consistent and more stable than essay tests, but both objective test and essay correlations with a term paper and class exercises were low and nonsignificantly different from each other.

It is important in determining grades to discover if the two styles of evaluation emphasize different abilities. Andrews (op. cit.) refers to the "distortion" of a test, i. e. variance that is attributable to the format of the test and that may be correlated with different test taking abilities independently of achievement or general ability. She points out that distortion is not always a bad thing educationally: the ability to write fluent prose irrespective of content, for instance, may be a form of distortion that teachers would encourage.

So far, then, the objective test vs. essay issue revolves around two main questions:

1. Can the variance of several essay and objective measures of the same course content be partitioned into (a) a common "knowledge" component that would presumably be the most suitable for grading purposes, and (b) specific components attributable to the format characteristics of the evaluating instruments?

2. Is test distortion related to any stable characteristics of the student?

Test distortion and student characteristics

One likely source of distortion in objective tests is the cognitive style of convergence (Guilford, 1959) since the "one correct answer" format is the main characteristic of convergent production. Other personality-type variables may be implicated. Rokeach and Norrell (1966) argued that essay evaluations would tap the synthesizing ability of the student, as measured by low scoring on the dogmatism scale; while objective tests would relate to analytic ability, as measured by low scores on the Gough-Sanford rigidity scale. Their results were, however, nonsignificant. It seems highly probable that other personality characteristics would be involved, but there appears to be no further research evidence on this.

Another fruitful domain may involve study behavior. One of the aims of teaching, including evaluation, would be to help the learner become functionally autonomous; to transform the other-reinforcing teaching situation into a self-reinforcing learning situation (Bruner, 1966). It is important to discover, then, if distortions due to different test formats are related to strategies of learning and studying, and in particular, to what might be considered to be desirable study strategies.

Certainly it is a common assumption that mode of evaluation affects study behavior. In summarizing the relative advantages and disadvantages of the essay and objective methods of evaluation, Adams (1964) claims that the essay "stimulates use of superior study methods in preparation (as compared with study methods used in preparing for objective tests)" (p. 330). Correspondingly, objective tests "may stimulate superficial learning of many details because of (a) emphasis placed upon recognition of correct answers rather than remembering; (b) failure to require the student to organize significant facts and ideas and to reason about them" (op. cit. p. 331).

It is difficult, however, to find any firm supporting evidence for these claims. Terry (1933) gave a checklist of study behavior items to two psychology classes, with instructions that students check (a) those items that applied to their own study behavior, (b) those they thought best suited in preparing for evaluation by essay only (c) by objective test only, and (d) by both. There was general agreement amongst students on (b), (c) and (d). The objective list contained items such as: look for details, underscore, rote learn names and new terms,practice recalling key sentences, etc. The essay list: obtain general idea of paragraph before reading in detail, recall chapter sub-topics in own words, inter-relate chapter themes, etc. Applicable to both: pay special attention to points raised in class, review class notes carefully, check unclear points in set text, etc. Despite Terry's claim that "study behavior is influenced to a significant extent by the teacher's selection of tests", his data clearly only confirm that students appear to <u>believe</u> that different study behaviors relate differentially to modes of evaluation. The only study that could be found in which data on study methods (self-report and observation) were specifically related to objective and essay performance is reported by Hakstian (in press). He concludes that students do not prepare differently -- in terms of time spent, organization of material, and techniques employed -- when expecting objective, essay or combined evaluation; and regardless of expectations, no evidence could be found that essay preparation or performance called on higher cognitive processes than objective tests.

In a previous study, Biggs (1970) found that study behavior interacted with Arts-Science performance. Success in Science was closely related to prior attainment in the same content area, that in Arts to two rather different kinds of study strategy, simplifying and self-structuring. It was argued that whereas the Science student needs to assimilate familiar categories of information to an already well established cognitive structure: the Arts student is faced with large masses of loosely organized and ..... 5 .....

relatively novel material and to incorporate it, needs to derive and impose his own structure upon it. There are thus two options available to the Arts student: to adopt the sophisticated strategy of creating his own multidimensional matrix, or to simplify the task by sticking to set texts and rote learning. Both strategies were found to be related to success, but clearly they were used by different students. It was suggested, although not possible to confirm, that those students with a pragmatic orientation to their studies (the subjects were all students undergoing preliminary degree work before teacher training) would be expected to comprise the simplifiers, while those with more academic ambitions would make up the structurers. The possibility that students with different value-motivational orientations to their work would utilize some strategies more effectively than other strategies is clearly relevant to the present issue and will also be examined here.

The situation is thus a complex one involving interactions between study strategies and value-motivational factors on the one hand, and study strategies and task variables on the other. Many factors decide whether or not a given approach to study is a "good" one, and so one cannot claim that essay evaluations promote "superior" study methods (v.s.), unless we also specify in what sense the methods are superior, for whom, and for what course content.

In the present investigation we are concerned with the following questions:

1. Can objective and essay measures of the same course content define a common distortion-free achievement parameter, together with specific format-style parameters?

2. Can the general achievement and test distortion parameters be related to the study strategies used by the student?

3. Are the relationships observed in (2) themselves moderated by the value-motivational orientation of the student?

Method

The investigation was carried out in two Educational Psychology courses on learning theory and applications to teaching, in which the writer was both instructor and examiner. Attempts were made to keep teaching methods, syllabus and examinations identical for each group. There were 40 students in each, most of whom were at the third year of the four year B.Ed. course, but because of incomplete observations the final analyses were carried out on a total N of 60.

1. The course evaluation measures

The following performance measures were used:

1. Term paper. This was a 3,000 word paper written by the student during the term. There was a choice of topics: (i) the application of the principles of learning to the student's special teaching area, or (ii) a discussion of the nature-nurture controversy, with reference to attempts to raise intelligence by special educational programs. Roughly equal numbers attempted each topic, and there were no differences in grades between topics.

2. Objective test final. This was a multiple choice test, four alternatives per item, that was common to most sections of the course (there were 14 sections, of which the writer taught two, and the syllabus and teaching methods varied somewhat between instructors). This test was designed to cover a common core between sections.

3. Essay final. This was an hour long essay, written under examination conditions, in which the student evaluated the relevance of the course to his future career as a teacher. The students were given advance notice of the question. Essays were marked globally for overall quality.

4. Short answer final. Students chose three short answer questions out of six specific aspects of the curriculum. Total time allotted was one hour and this section was written under examination conditions with no advance notice of questions. Students were instructed to answer briefly, in note form. Answers were marked analytically.

5. Objective test midterm. This was a specially constructed objective test, administered halfway through the course. There were two sections. The first was a multiple choice section, with 30 items and five alternatives per item. Students were instructed to choose one of the five alternatives, but were also told that one of the alternatives carried two marks, while one other also was correct but less satisfactory and carried only one mark. The second section consisted of twenty true-false items with no penalty for guessing. The final score was the sum of the marks gained in section 1 plus the number of true-false items correct.

Intercorrelations between these five components and a principal components factor analysis of the matrix, are given in Table 1:

Insert Table 1 here

The first (unrotated) factor is interpreted as a distortion-free general achievement factor for the course; there is a strong case for arguing that this should be used for determining final grades. The midterm objective has the highest loading, and the final essay the lowest, but all measures load significantly.

The second factor is most easily interpreted as a distortion factor, which is independent of achievement. The common objective marks the positive pole, and the final essay question the opposite pole. It would have been possible to carry out all further analyses using factor scores on these two factors as the dependent variables but it was considered desirable to have independent measures of essay-style and obejctive-style, to allow the possibility that the two styles are merely different, not necessarily opposed.

It was decided to rescore the midterm objective. It is clear from the first principal component that this test loads highly on general class achievement; it is likely that the most important part of the variance relating to general achievement would be that due to the complex responses carrying two marks than to the simple responses or to the true-false section. Accordingly, section one was rescored to yield a complexity score (all complex responses checked) and a simplicity score (all simple scores checked). Incorrect scores were ignored. The true-false score was obtained separately. Examples of complex and simple scoring are as follows:

> "What is usually thought to be the mechanism of reinforcement in instrumental learning?
>
> 1. the strengthening of the learned response (47% - .11).
> 2. operant chaining (8%; - .52).
> 3. alterations in drive level following any response (29%; . 36).
> 4. occurrence of the UCS just after the CS (14%; .05).
> 5. a feeling of certainty" (3%; - .29).

The item asks for explanations in terms of a mechanism, not a mere description, so (1) [illegible] scored as a simple response (47% checked this alternative: the biserial correlation with total score was -.11). (3) was the complex response (checked by 29%, + .36 with total score). The other alternatives are wrong.

> "Arithmetic refers to relationships particular numbers have to each other; algebra to properties of numbers in general. Algebra would therefore require:
>
> 1. divergent thinking (23%; - .22)
> 2. cognitive complexity (25%; - .27)
> 3. formal operational thinking (29%; .55)
> 4. a higher level of general intelligence (25%; .07)
> 5. a higher tolerance of ambiguity" (20%; -. 14).

(4) is correct but trivial, and was a simple response; (3) constituted the complex response.

The set of intercorrelations between the other measures and these subscores, and a varimax rotation of the factor matrix, is as follows:

Insert Table 2 here

The first factor is a complexity-simplicity factor, which accounts for 35% of the common variance. Factor scores were correlated with the unrotated general achievement factor scores and their intercorrelation was .906 (Table 4, line 1), which is remarkably high.

The traditional polarity in marking is in terms of correct vs. incorrect: the present data suggest that this polarity is not an efficient one, at senior undergraduate level. In fact, ordering the students on a dimension that opposes complex responders against simple (but "correct") responders achieves a very similar result to ordering the students on all the other measures, term paper, common objective, essay, short answer and

midterm objective. This is in itself an interesting finding. Considering that this section of the test took only 20 minutes or so to answer, whereas the time spent on term papers and finals would run into hours, the procedure suggests itself as a highly economical one in terms of evaluation. Obviously, though, it would need to be replicated several times before it should be used to replace these other more lengthy, and almost certainly less reliable, procedures.

Psychologically, the finding suggests that the high achieving student, whatever the mode of evaluation, is likely to adopt fine input-code match criteria, the poor student coarse and poorly analyzed match criteria (Biggs, 1969, p. 299). The complexity-simplicity dimension thus appears to reflect a distortion-free "academic intelligence" factor; empirically, its high correlation with general achievement justifies using factor scores on this dimension as a measure of general achievement.

The two remaining factors are clearly the objective and essay style factors respectively, which are independent of achievement and therefore probably represent distortion due to test format. The true-false and short answer (which was scored "objectively") scores load most highly on the second factor, with all other objective tests having positive loadings. The third factor was marked by the two essay style ratings.

These results seem to answer the first question. The first factor was not in fact derived as a general achievement factor, but it correlated very highly with the common variance of all measures; this variance, moreover, may be supposed distortion-free. Factors two and three appear to be reasonably interpreted as format-style factors. Factor scores on the three factors obtained in the varimax analysis were therefore used as dependent variables in subsequent analyses of variance; the scores were standardized to a mean of 0 and a standard deviation of 1.

2. Study Behavior variables

During the course of the term, a Study Behavior Questionnaire (SBQ) was administered to both classes. The SBQ was adapted from a previous scale use by the writer (Biggs, 1970) and consisted of items concerning the student's habitual methods of studying, with additional items referring to attitudes to university and coursework. The student rated himself on each of the 80 items on a 5-point scale, agreement rating high. # There is evidence (Braun, 1970) that maximally reliable and valid subscales from study behavior inventories (Braun used the Brown-Holzman SSHA) are obtained by scaling from within the population tested. However, as the number of subjects in relation to items scarcely warranted the use of factor analysis,which was used in the earlier study (Biggs, op. cit.), the method of homogeneous keying (Dubois, Loevinger and Gleser, 1952) was employed here. In the latter method, items are added to a cluster (subscale) until maximal scale consistency (KR - 20) is reached. This technique is a good approximation to a varimax solution (Gupta, 1968). In the present case, however, the method was found to be only partially satisfactory. In particular, it was theoretically desirable to separate "motivational" from "strategic" subscales but because of the first order correlations between attitude items and behavior items, clusters drawing from both motivational and strategic domains kept appearing. In the event a compromise was reached: unidimensional empirically derived scales were used together with a priori scales (the latter being theoretically "pure" but their actual dimensionality in the population was unknown). Seven empirical and four a priori scales were obtained: these are listed below (KR - 20s are available on the empirical scales only) together with a few typical items from each:

Value-Motivational	KR-20	Typical items (abbreviated)
1. Pragmatism (3 items)	.692	Choose university subjects with practical value. At university to pass examinations.
2. Class orientation (8 items)	.679	Would ask question so lecturer would think well of me Easier to learn from staff members I like Take lectured material very seriously.
3. Academic interest (7 items)	.817	Become increasingly absorbed in my work All studies highly interesting
4. Achievement-organization (6 items)	.813	Work consistently throughout year; take revision steadily Strong desire to excel in all subjects.
5. Academic neuroticism (8 items)	----	New approach to known topic confusing and depressing Study only easy parts when prescribed work is difficult Difficult to keep track of reading and relate it together
Study Strategies		
6. Wide reading (6 items)	.815	Consider myself better read than most students Read recommended material before a lecture
7. Simplifying (11 items)	.820	Learn best from short textbook with no extras Keep essentially related topics apart when revising Study previous examination papers
8. Fact-rote (10 items)	.752	Prefer factual to theoretical subjects Go back and test myself on doubtful points Memorize details by heart Don't question teacher's interpretations

9.	Scheduling (5 items)	----	Plan exam answers before writing Don't let assignments mount up Work out study schedule in advance and keep to it
10.	Dependence (6 items)	----	Prefer specific assignment to general direction Rather have something explained than work it out myself
11.	Relating (5 items)	----	Try to relate one subject to what I've learned in other subjects Try to question new ideas by thinking up exceptions

Scale intercorrelations are given in Table 3

Insert Table 3 here

In general, it may be seen that the value-motivational factors refer to academic attitudes; strategies to behaviors. The two domains tend to intercorrelate, but there is a logical distinction between them. It is interesting to note that several dimensions strongly recal Terry's (1933) item listings for study behaviors appropriate to objective, essay and combined modes of evaluation (v.s.).

3. Analyses

First, all performance and study behavior variables were intercorrelated. To study interactions, a multivariate analysis of variance program was used. The sample was split at the medians of the study behavior variables to produce hi-lo groups: these formed the independent variables. The performance variables formed the dependent set. The main effects and interactions of selected combinations of independent variables, taken three at a time, on all three performance measures were examined, first for

univariate and then for multivariate effects. The significance of the multivariate F ratio indicates that the particular effect is significantly different across the dependent variables.

The choice of combinations of independent variables was made on two grounds. First, intercorrelations between any given three study behavior dimensions were to be minimal. Once this criterion had been reached, selection was made on what were a priori interesting or reasonable combinations; selection on these grounds was however difficult in view of the absence of any prior related research with respect to interactional effects.

Results

The correlations between study behavior and performance variables are set out in Table 4. The principal components general achievement factor is also included here: as can be seen, it correlates very highly with the first varimax complexity-simplicity factor and their correlations with study behavior variables are alike. These data appear to justify the use of the varimax factor as a general achievement factor; accordingly it is labelled and interpreted as such in the ensuing analyses of variance.

Insert Table 4 here

Of the value-motivational dimensions of study behavior, academic interest and academic neuroticism both correlate significantly with general achievement as would be expected: those with an academic interest in their

study tend to do well, and those who report feeling confused and depressed tend to do badly. Pragmatic students, who see their university careers as a means to a practical goal, tend to do well on objective tests.

Wide reading and relating strategies both appear adaptive ones for general achievement, while simplifying is seen to correlate negatively with achievement. A fact-rote strategy is adaptive for objective tests, likewise scheduling. It is interesting to note that scheduling appears to be unrelated to general achievement, despite a common assumption that it is basic to any "good" set of study skills (e. g. Brown and Holzman, 1955; Morgan and Deese, 1957; Robinson, 1961).

The other feature of Table 4 that requires comment is the absence of any correlations with essay style. This could mean that these variables are in fact unrelated to essay writing; or that the essay factor scores are due to characteristics of the marker rather than to those of the student. However, there may well be interactive effects that would not be shown by the correlations.

Six multivariate analyses of variance (Manova) were carried out; the resulting F ratios and cell means are reported in the appendix.

Table 5 summarizes the results of the Manovas:

Insert Table 5 here

The main effects, not surprisingly, give similar results to the correlations. Exceptions are that scheduling no longer appear as a main effect on the objective score, but dependence does; while a main effect,

only when a fact-rote strategy is adopted. Two different kinds of learning may thus be involved. The first is self-initiated and self-structured and may lead to high achievement; the second is initiated by class involvement, is essentially factual and may also lead to high achievement.

The second interaction (Fig. 1(d)) paints a somewhat similar picture. With low class orientation, scheduling is associated with high achievement with independent but not with dependent students; whereas with high class involvement scheduling is associated with high achievement with dependent but not with independent students. Scheduling is essentially self-initiated, and in the absence of strong leads from the class and the instructor does not apparently lead to high achievement in dependent students.

The only interaction on the objective score involved pragmatism x fact-rote ($P < .05$; Figure 2; Manova 2).

Insert Figure 2 here

Although pragmatism and fact-rote both correlated with the objective score (Table 4), this interaction shows that the strategy of focussing on detail and memorizing it applied only to pragmatically oriented students.

Two interactions applied to the essay score:

Insert Figure 3 here

Academic interest x simplifying x relating ($P < .05$ Figure 3(a); Manova 5) shows that although relating is unilaterally effective with

fact-rote, appears on the essay score.

Several interactions are significant; they are described below, fuller discussion following in the next section. The original analyses of variance are referred to by number in the appendix.

Figure 1 depicts the interactions on achievement.

Insert Figure 1 here

Pragmatism x class orientation ($P < .05$; Fig. 1 (a); Manova 1) shows a crossover interaction on achievement. Pragmatic students do better when they are class oriented, while non-pragmatic students do better when they are not.

Achievement-organization and fact-rote strategies have a cross-over interaction ($P < .05$; Fig. 1 (b); Manova 6). A student who is grade oriented may make quite effective use of fact-rote strategies: if he is not grade-oriented, higher order strategies appear to be more appropriate.

The implication that different strategies are more effective with differing value orientations is also borne out in Figures 1 (c) and 1 (d), involving class orientation x wide reading x fact-rote ($P < .01$; Manova 3) and class orientation x scheduling x dependence ($P < .01$; Manova 6).

While wide reading emerged as a main effect on achievement, the interaction (Fig. 1 (c), shows that the effectiveness of wide reading depends upon other conditions. When the student reads widely, is not oriented towards the class, and does not adopt a fact-rote strategy, achievement is high; but when he is oriented to the class, wide reading is related to achievement

regard to achievement itself, it is only conditionally effective on the essay score. Students with low academic interest and who did not simplify achieved better essay ratings when they inter-related, but low simplifiers under high academic interest did better when they did not inter-relate. Relating was important for students who had high academic interest and who simplified; high simplifiers and low relaters achieved very poor essay ratings. This is a complex interaction and will be discussed in the next section.

The remaining interaction involves scheduling x dependence on the essay rating ($P < .05$; Fig. 3(a); Manova 4). Students who were dependent, and did not schedule, obtained better ratings than if they did schedule, and better than independent students whether or not they scheduled.

General Discussion

The analyses of variance showed clearly that several value-motivational and strategy dimensions of study behavior relate to general achievement and to objective-style and essay-style test distortion. Of the sixteen main effects and interactions that were involved, eight related to achievement itself. The first general conclusion would be, then, that study behavior is connected with both power and style of performance. The three performance parameters will be discussed in detail below.

1. General Achievement

Three straight main effects related to achievement. The first was a motivational dimension, academic neuroticism. Students who reported that they were easily confused by a novel approach, who were flustered before examinations and who couldn't maintain interest in their work not surprisingly achieved poorly. Second, students who adopted a simplifying

strategy (memorized details by heart, studied only easy parts, believed there were clearcut answers to most problems, kept related topics apart during revision, etc.) also achieved poorly. The neuroticism and simplifying strategies are no doubt functionally related (r = .638); students who feel academically inadequate are likely to be those who attempt to cope maladaptively by over-simplifying the issues and studying accordingly.

The third main effect was a relating or integrating strategy (try to relate new learnings to previously learned material, expect to find answers in reading to questions formed from related material, etc.) and this was related to high achievement.

Width of reading (spend more time reading than other students, better read than most, etc.) appeared as a main effect and also in interaction with classroom orientation (ask questions to impress lecturer, take lectured material very seriously) and fact-rote strategies (prefer factual to theoretical approach, memorize details by heart, etc.). The effectiveness of reading widely depended upon whether the student read factually or nonfactually, and whether he read prescribed class material only or more widely. It appears that the student who reads beyond class materials achieves well with a nonfactual approach; but if he is oriented towards class materials, he achieves better by adopting a factual-rote approach to his reading material.

Classroom orientation was involved in two other sets of interactions on achievement. Students who were not classroom oriented and who preferred to work independently (preferred to make up own reading list, rather work out problem on own than have explained) achieved very well when they scheduled their study sessions (set target for each study session, etc.), but class oriented students who scheduled achieved better when they were dependent.

Second, class orientation interacted with pragmatism (choose university subjects with practical value, at university to achieve professional/financial status, etc). Pragmatic students did better when they were class oriented, while nonpragmatic students who were not class-oriented achieved best of all.

Another interaction on achievement involved the fact-rote strategy and achievement-organization (work consistently throughout year, strong desire to excel). Students who are achieving-organizers do badly if they do not incorporate a fact-rote strategy into their study behavior, while low achieving-organizers do badly if they <u>do</u> use a fact-rote strategy.

These results add up to a fairly consistent picture.

1. High achievement is associated with wide reading, independence and an integrated relating approach to work; low achievement with feelings of inadequacy and simplifying strategies.
2. However, students who do not read widely and who do not integrate can still achieve well if (a) they are sufficiently achievement oriented, (b) they see the place their university studies as a means to an end, and (c) adopt behaviors involving close identification with the classroom situation, a fact-rote strategy, scheduling, covering set reading lists, etc. The critical factor here seems to be that they "keep their cool": simplifying strategies may apparently work as long as they are not the result of despair or panic.

High achievement thus appears to be the result of two quite different processes. The first involves integrative or <u>transformational</u> strategies; the second lower order <u>reproductive</u> strategies. The success of reproductive strategies depends, however, on motivational antecedents; i. e. a clear view of the course as a means to an end, and a strong desire to excel

coupled with the determination to work steadily and consistently. These data confirm a previous finding (Biggs, 1970) that simplifying and self-structuring strategies were both related to success in first year Arts. It was suggested there that the simplifiers probably regarded their course simply as a necessary professional qualification, while the relaters were more academically oriented. The present results would confirm this interpretation.

2. Objective style

Two main effects were related to objective style performance independently of achievement and essay style. These were scheduling, and dependence. The other two objective style main effects, pragmatism and fact-rote, were modified by their interaction: this showed that pragmatic students who adopted a fact-rote strategy did rather better on the objective tests than all other students.

These four factors -- scheduling, pragmatism, fact-rote, and dependence -- suggest a convergent style of operating. The student who knows where he is going, pays attention to and rote learns detail, programs his work minutely, works consistently, and follows the teacher's lead closely, strongly suggests the convergent student (Hudson, 1966; 1968). Moreover, scheduling and dependence have previously been shown to correlate negatively with Guilford's Uses of Objects Test (Biggs, in press). It is not surprising, then, that such a student favors an objective, "one correct answer" style of evaluation.

The results with respect to the objective style factor can thus be explained, at least in part, in terms of convergence. Where final grades incorporate objective measures, it seems likely that students who are generally convergent in style would achieve a higher grade than they "ought"

on the basis of ability alone, while divergently biassed students would achieve a lower grade. However, it must also be remembered that the first factor itself was defined by two scores derived from an objective test -- and which correlated very highly with the unrotated "general achievement" factor.

3. Essay style

First order correlations were all zero with the essay style factor. In the analyses of variance only one main effect emerged, fact-rote: students adopting this strategy did better in the essay style questions than those who did not. This finding was somewhat surprising as the writer thought he took particular care in the final exam question not to give credit for factual recal. One student in her answer repeated almost verbatim large slabs of the author's own text and was marked accordingly. It appears that other students adopting the same strategy, only not so blatantly, may have got away with better marks than the marker intended.

All other effects involving the essay score could also be interpreted to some extent in terms of marker interaction.

There was a complex interaction involving the essay style factor and academic interest, simplifying and relating strategies. Highest ratings were achieved by students of low academic interest who were high relaters and low simplifiers; lowest ratings were obtained by highly interested students who were high simplifiers and low relaters. Part of this interaction, dealing with the effect of relating on low simplifiers, suggests that maximal complexity can be handled by the student who is detached from his material, but when he is deeply involved (as some students were when discussing Head Start programs) inter-relating can lead to confusion and lack of clarity. When on the other hand the deeply involved student simplifies the task, e. g. by dealing with only some rather than all issues,

he can inter-relate more effectively. This general pattern is very reminiscent of the Yerkes Dodson Law on motivation and task complexity.

The other feature of this interaction is to do with the poor showing of the maximally simple students who were deeply involved: for example, an enthusiastic, uncritical and oversimplified account of the Head Start programs received relatively poor marks. In brief, this interaction shows that at a low level of interest good marks are associated with maximal complexity; while at a high level of interest, poor marks are associated with maximal simplicity, given that general ability has already been considered. Other markers would no doubt emphasize different features, and would show different interactions.

The final interaction involving scheduling and dependence showed that best essay ratings were obtained by dependent students who did not schedule their work: all other groups achieved roughly equal ratings. This might best be interpreted in terms of maximal dependence: scheduling is an autonomous activity so that those students who were dependent in class and accepted given reading and studying times rather than scheduling their own were rated inordinately high by the instructor. This looks rather like a "give the prof what he wants" strategy. It would be important to discover how general this interaction is in other courses and how often in the past this kind of maximal dependence has indeed been reinforced by the professor, as it apparently has been here, by obligingly over-rating maximally dependent students. Again, the present writer had the conscious impression that he was not marking in this manner but rather the opposite.

These essay main effects and interactions do seem to say a great deal about the marker in that he reliably appears to favor certain characteristics of students and to disfavor others. It is thus not strictly

accurate to call essay marks "subjective": rather they are an "inter-subjective" interaction between what the marker values (whether he knows it or not) and how the students operate. It seems important then for the marker to discover just what student characteristics are associated with his essay ratings. He needs then to ask himself whether these are what he would consider to be valuable characteristics and strategies to be reinforcing.

In the present case, once the variance due to achievement itself had been removed, the marker seemed to be assigning high grades to those students who saw an issue detachedly from several angles and who tried to interrelate these angles, and to be marking down zealous oversimplification. This corresponds well with what this marker woul have consciously admitted. However, less desirably, it appears that he was also marking up those students who were maximally dependent upon the instructor and those who rote learned what they (apparently correctly) saw to be material valued by the instructor. This is important information for an instructor to have, and if nothing else, the present technique suggests a way in which an instructor can obtain feedback about student characteristics that influence his essay ratings.

Implications

In discussing implications that this study has for education it must first be emphasized that the present results were obtained in two classes, with a net N of 60, involving only one curriculum and one instructor. Obviously replication on a wider scale is indicated. Nevertheless, certain suggestive features stand out and these are best summarized in terms of the original questions asked at the end of the first section of this paper.

1. Can a distortion-free parameter referring to general achievement be separated from obtained from essay and objective evaluations, and can "distorted" format style parameters be shown also to exist?

The answer in both cases is in the affirmative. In the present case, both objective and essay evaluations were shown to contribute to a general achievement dimension and both are therefore useful in determining final grades. However, it should be pointed out that distortion parameters also exist: in the first principal components analysis, both kinds of distortion together accounted for one-third as much variance as the principal general achievement factor. This suggests that the common practice of pooling essay and objective scores for the purpose of obtaining final grades is not justified since this confounds distortion-free and distorted estimates of achievement. And since the distorted estimates do correlate with individual, pedagogically irrelevant, characteristics, a grade based upon simple pooling of raw scores would be influenced by these educationally speaking irrelevant characteristics, such as value orientations, convergent cognitive style, etc., and to that extent is "unfair". It should also be pointed out that this difficulty is not overcome by simply using one mode of evaluation: both essay and objective styles were each shown to contain their own form of distortion. It is likely that this would also be true of any other form of evalution, e. g. self-evaluation and evaluation by fellow students. The answer would appear to be that evaluation modes should be widely spread and factor scores on the first principal component, or on a factor that correlates highly with this, should be used for the final grade distribution. This procedure would of course presuppose that undue emphasis is not given to any one mode; and that numbers of students would be sufficient to warrant the use of the appropriate statistical techniques. It is of course a separate question to decide where the pass - fail, credit and other grade

cut-off points should be along this distribution.

2. Can the general achievement and format style parameters be related to the study behavior of the student?

The present study again indicates clearly that the answer is yes. General achievement was associated with two levels of strategy, transformational and reproductive, the first involving wide reading and interrelating, the second rote learning, as long as the latter was accompanied by positive (achievement oriented) motivations, and not, as is frequently the case, negative cannot-cope self-evaluations.

It is worth asking what these results amount to educationally. While an instructor should be gratified to find that "academic" students, who read widely and integrate their work, etc., do well in his course, he might be less pleased to discover that opportunistic students, who adopt such unacademic strategies as rote learning and slavish adherence to prescribed course work etc., also do well. Perhaps one needs to be realistic. In professional training faculties it is a fact, however lamentable in terms of the instructor's own personal value system, that many students are at university simply to obtain their paper qualifications.

The view one takes of this would depend upon one's educational philosophy. One suggestion is that the instructor rethink what it is his teaching and evaluative techniques chiefly emphasize, in terms of cognitive process; another is that he rethink the content and orientation of his course so that where the latter is more obviously related to professional preparation the pragmatically oriented student may not find it necessary to resort to low level short cuts to learning. But this again may conflict with what the instructor thinks professional preparation is all about.

Objective performance, independently of achievement, was associated with strategies and attitudes that are related to a convergent cognitive style, although on the present data it was not possible to show that all the significant objective test distortion could be accounted for in terms of convergence. While this distortion is of considerable psychological interest, it is educationally irrelevant provided that the distortion is removed from the straight achievement variance.

Two general observations arise out of the essay-style results. The first is that the results clearly show that, once the achievement variance is accounted for, the marker's conscious evaluating criteria do not necessarily play the role he wants them to. "Giving the prof what he wants" --- despite explicit warnings to the class against just this, and despite intentions to the contrary -- is a strategy that boosted essay ratings (which is not to say that students were consciously aware of using it either). Second, the present analyses suggest a method that the essay marker may use to ascertain what factors influence his marks. Research on essay marking makes it clear (e. g. Cast, 1939 - 1940; Nyberg, 1965) that reliable rating depends upon explicit formulation of rating categories.

The present results therefore do not support Adam's (1964) assertion that essay evaluation promotes superior study methods. Although superior strategies (low simplifying and high relating) were associated with good essay ratings, it must be remembered that both simplifying and relating strategies have already been observed as main effects (negative and positive respectively) on the distortion-free achievement parameter. Thus, "superior" methods were effective whatever the mode of assessment.

3. Do value-motivational factors moderate the effects of study strategies? This has already shown to be so. The general implication here is that effective study behavior needs to be viewed within the total context of the student's view of, and feelings about, his class work. Thus, improving study behavior cannot realistically be regarded as a training job in study skills per se. The present findings are in line with previous work (Biggs, in press) suggesting a close link between personality characteristics and effectiveness of study behavior. It was concluded there that work on improving study behavior might begin by looking first at personality and motivational antecedents, before attempting to influence study behavior directly.

4. A side result of the present study was the use of a complexity-simplicity dimension in scoring objective tests. Where two out of five alternative responses to an item were correct, but one was more sophisticated than the other, students were ordered on a factor that contrasted the two classes of response; this order was almost identical with that obtained by ordering along a distortion-free dimension defined by all class evaluations. In view of the convenience and reliability of this assessment, this finding certainly warrants replication on a wider scale.

Summary

When all the performance measures that were used for grading purposes in two undergraduate classes in Educational Psychology were factor analyzed, it was found that 67% of the total variation in the measures could be accounted for by three orthogonal factors, each of which accounted for just over 20% of the total variance. The first factor was closely related to general achievement, the second to objective style and the third to essay style of performanc. The purpose of this study was to find out how far each of these factors was related to value-motivational and strategic dimensions of study behavior.

General achievement was determined in part by the study strategies the student used, and the effectiveness of these strategies was shown to depend further upon the value-motivational orientation of the student. High level, integrating strategies were effective for most students, but low level factually oriented rote learning strategies were also effective given appropriate achievement motivation.

Objective test performance was related, independently of ability, to a variety of factors that appeared to be closely related to Guilford's (1959) style of convergent production. Essay ratings were also related to student characteristics, independently of ability: the important finding here was that the instructor was by no means always aware that he was upgrading these characteristics.

It was concluded that both essay and objective evaluations are useful to the instructor. Practical considerations (ease of administration and speed of feedback; value of writing continuous prose, etc.) would determine when and where the different test modes would be used, but for evaluative purposes it would be important that the distortion due to test format be removed from the distribution on which final grades are based. Other implications, with respect to the kinds of study attitudes and study behaviors that led to different kinds of performance, and to improving study behavior, were discussed. In general, it was concluded that the method of evaluation did not necessarily promote one kind of study behavior as opposed to another; the situation appears to be more complex than that.

References

Adams, G. S. Measurement and evaluation in Education, Psychology and Guidance, New York: Holt, Rinehart and Winston, 1964.

Andrews, Ann S. Multiple choice and essay tests. Improving College and University Teaching. 1968, 16, 61 - 6.

Biggs, J. B. Coding and cognitive behavior. Brit. J. Psychol. 1969, 60, 287 - 305.

Biggs, J. B. Faculty patterns in study behavior. Aust. J. Psychol. 1970, 22, 161 - 174.

Biggs, J. B. Personality correlates of some dimensions of study behavior. Aust J. Psychol. (In Press).

Braun, P. Subjective and psychometric non-cognitive scales in relation to over-and underachievement. Unpub. M. Ed. Thesis, Dept. of Educational Psychology, University of Alberta, 1970.

Brown, W. F., and Holtzman, W. H. A study-attitudes questionnaire for predicting academic success. J. Educ. Psychol. 46, 75 - 84, 1955.

Bruner, J. S. Toward a theory of instruction. Harvard University Boston, Press, 1966.

Cast, B. M.D. The efficiency of different methods of marking English composition. Brit. J. Educ. Psychol. 1939, 9, 257 - 269; 1940, 10, 49 - 60.

Dubois, P. H., Loevinger, J., and Gleser, G. C., The construction of homogeneous keys for a biographical inventory. Air Training Command, Human Resources Research Center, Research Bulletin, 52 - 18; Lackland Air Force Base, San Antonio, Texas, May, 1952.

Guilford, J. P., Three faces of intellect. Amer. Psychol. 1959, 14, 469 - 479.

Gupta, R. K., Certain techniques of multivariate analysis applied to different measures of inter-item relationships for developing unifactor tests. J. Ed. Measurement, 1968, 5, 223 - 230.

Gustav, Alice. Objective vs. essay tests. Improving College and University Teaching, 1968, 16, 60.

Hakstian, R. The effects of type of examination anticipated on test preparation and performance. J. Ed. Res. (In press).

Hudson, Liam, Contrary Imaginations. London: Methuen, 1966.

Hudson, Liam. Frames of mind. London: Methuen, 1968.

Morgan, C. T., and Deese, J. How to study. New York: McGraw-Hill, 1957.

Nyberg, V. R., A Factor analytic study of essay gradings. Unpublished, D. Ed. Thesis, U.C.L.A., 1966.

Robinson, F. P. Effective Study. N. Y: Harper and Row, Rev. Ed., 1961.

Rokeach, M. and Norrell, Gwendolyn, Analysis, synthesis and academic performance, (Part Two) Cooperative Research March Project, No. 879. Michigan State University. 1966.

Terry, P. W. How students review for objective and essay tests. Elem. School. J. 1933, 33, 529 - 603.

TABLE 1

INTERCORRELATIONS BETWEEN ALL ITEMS COMPRISING FINAL GRADE (N = 79)

		1	2	3	4
1.	Term Paper	-			
2.	Objective Final	.133	-		
3.	Essay Final	.462	.029	-	
4.	Short Answer Final	.225	.290	.175	-
5.	Objective Midterm	.421	.385	.180	.428

PRINCIPAL COMPONENTS ANALYSIS OF FINAL GRADE ITEMS

	1	11	Commun.
Term Paper	.708	-.464	.716
Objective (Final exam)	.536	.589	.634
Essay (Final exam)	.532	-.676	.740
Short Answer (Final exam)	.661	.294	.523
Objective (Mid term)	.785	.227	.668
Percent common variance	64.8	35.2	100.0

TABLE 2

INTERCORRELATIONS BETWEEN SEGREGATED COMPONENTS OF FINAL GRADE (N = 76)

		1	2	3	4	5	6
1.	Term Paper	-					
2.	Objective Final	.162	-				
3.	Essay Final	.445	.061	-			
4.	Short Answer Final	.208	.255	.181	-		
5.	Complexity	.252	.284	-.041	.153		
6.	Simplicity	-.149	-.148	-.048	.019	-.537	-
7.	True - False	.033	.251	.092	.287	.196	.058

VARIMAX SOLUTION OF SEGREGATED FINAL GRADE COMPONENTS

		II	II	III	Commun.
1.	Term Paper	.242	.086	.810	.722
2.	Objective (Final exam)	.323	.616	.034	.485
3.	Essay (Final exam)	-.103	.068	.859	.752
4.	Short Answer (Final exam)	-.040	.687	.271	.547
5.	Complexity	.840	.266	.021	.776
6.	Simplicity	-.868	.123	-.082	.775
7.	True - False	-.035	.787	-.056	.623
	Percent common variance	34.9	33.5	31.6	100.0
	Percent total variance	23.3	22.4	21.1	66.9

TABLE 3

INTERCORRELATIONS BETWEEN STUDY BEHAVIOR DIMENSIONS

		1	2	3	4	5	6	7	8	9	10
1.	Prag.	-									
2.	Class Or.	-.011	-								
3.	Ac. Int.	-.060	.082	-							
4.	Ach. Org.	.172	.054	.681**	-						
5.	Ac. Neurot.	.161	.291*	-.176	.057	-					
6.	Wide Read.	-.116	.185	.666**	.470**	-.159	-				
7.	Simp.	.387**	.187	-.234	.110	.638**	-.250*	-			
8.	Fact Rote	.391**	.123	-.153	.325**	.512**	-.195	.814**	-		
9.	Sched.	.255*	.109	.506**	.749**	-.080	.447**	.108	.247	-	
10.	Dep.	.371*	.183	-.344**	.037	.496**	-.344*	.569**	.638**	.080	
11.	Relat.	.090	.509**	.377**	.152	-.050	.462**	-.135	-.130	.242	-.095

*P < .05

**P < .01

TABLE 4

CORRELATIONS BETWEEN STUDY BEHAVIOR DIMENSIONS AND PERFORMANCE VARIABLES

	Gen. Ach. (Prin.Comp)	Gen. Ach. (Comp.Simp)	Objective	Essay
Gen. Ach. (Prin. Comp.)	1.000	.906**	.331**	-.030
1. Pragmatism	-.026	-.154	.266*	.006
2. Class Orientation	.032	-.027	.129	-.028
3. Acad. Interest	.249*	.191	.097	-.196
4. Achiev - organiz.	.167	.086	.181	-.123
5. Acad. Neurot.	-.251*	-.353**	.126	-.031
6. Wide reading	.277*	.252*	.157	-.175
7. Simplifying	-.243	-.312*	.165	-.018
8. Fact-rote	-.052	-.137	.279*	.134
9. Scheduling	.205	.108	.269*	-.116
10. Dependence	-.056	-.166	.240	.192
11. Relating	.331**	.297*	.190	.104

*P < .05

**P < .01

TABLE 5

SUMMARY OF ANALYSES OF VARIANCE INVOLVING SELECTED MOTIVATION-VALUE AND STRATEGY FACTORS

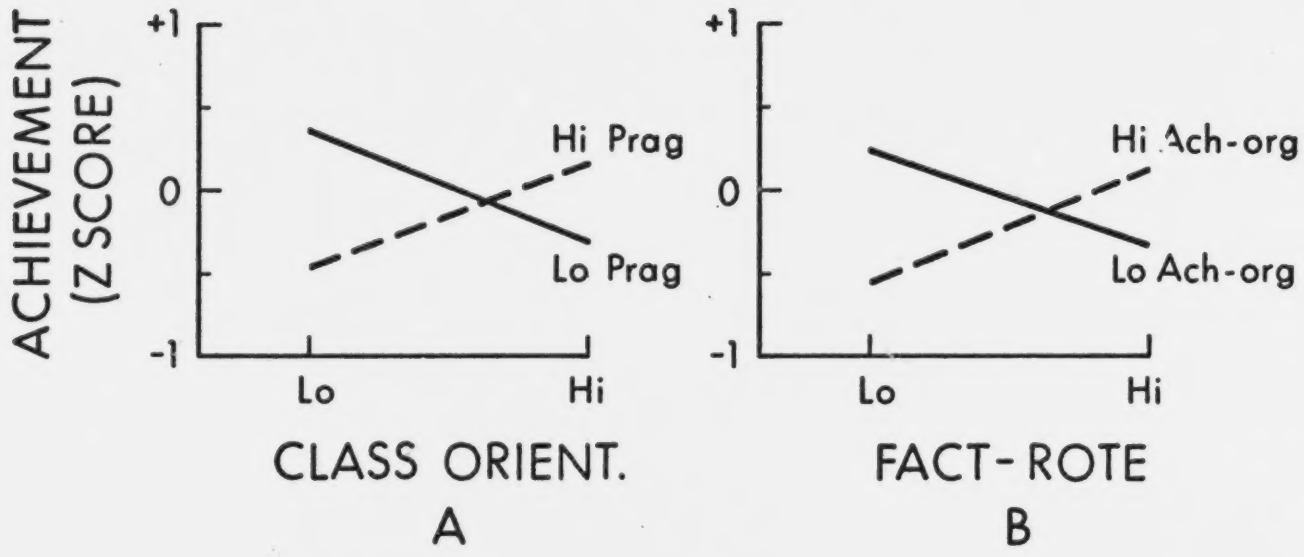
Factor	Significant Effects (at least P < .05)					
	Main			Interactions		
	Ach.	Obj.	Ess.	Ach.	Obj.	Ess.
Value - Motiv.						
1. Pragmatism		+		(1.2)	(1.8)	
2. Class Orient.				(1.2)(2.6.8) (2.9.10)		
3. Ac. Interest						(3.7.11)*
4. Ach. - Org.						
5. Ac. Neur.	-*					
Strategy						
6. Wide Read	+			(2.68)		
7. Simplifying	-					(3.7.11)*
8. Fact - Rote		+*	+	(2.6.8)(4.8)	(1.8)	
9. Schedul.				(2.9.10)		(9.10)*
10. Depend.		+*		(2.9.10)		(9.10)*
11. Relating	+					(3.7.11)*

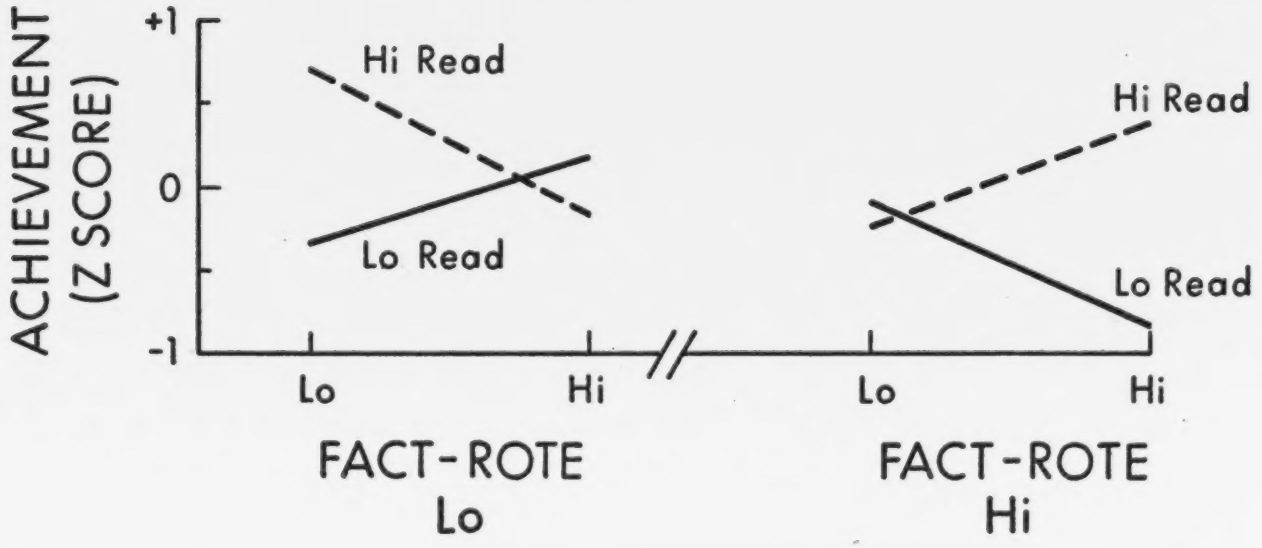
*Discriminant analysis significant at least P < .05.

+= positive main effect; -= negative main effect; (1.2) = Pragmatism x class orientation interaction (e. g.).

FIGURE 1

INTERACTIONS ON GENERAL ACHIEVEMENT


ACHIEVEMENT
(Z SCORE)
+1
0
-1
Hi Prag
Lo Prag
Lo
Hi
CLASS ORIENT.
A
+1
0
-1
Hi Ach-org
Lo Ach-org
Lo
Hi
FACT-ROTE
B


ACHIEVEMENT
(Z SCORE)
+1
0
-1
Hi Read
Lo Read
Lo
Hi
FACT-ROTE
Lo
Hi Read
Lo Read
Lo
Hi
FACT-ROTE
Hi
CLASS ORIENTATION
C

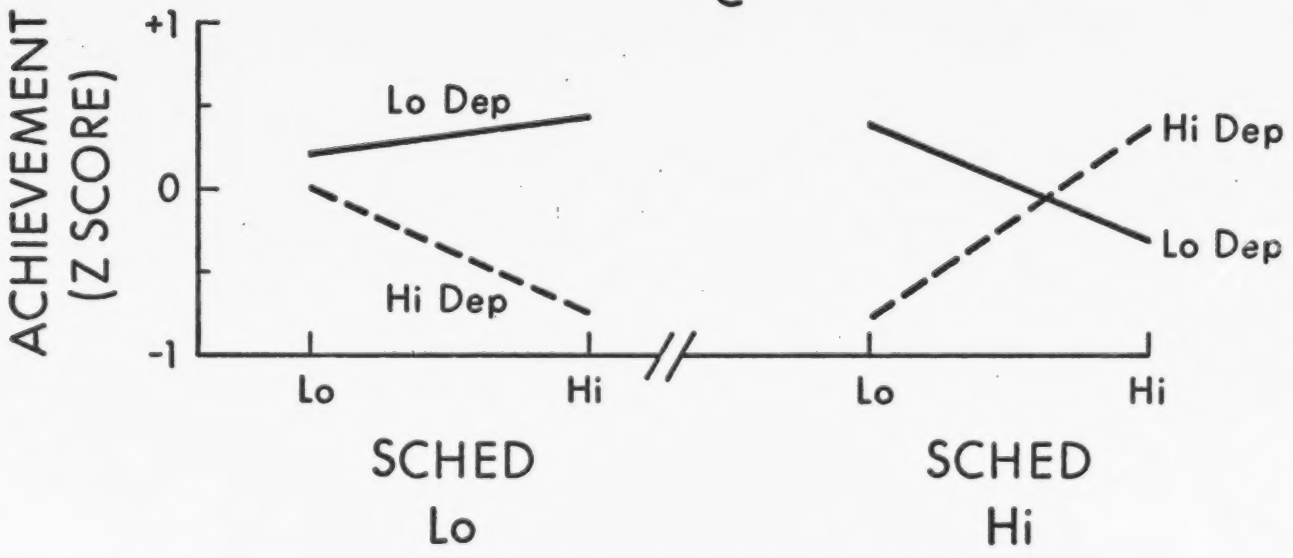

ACHIEVEMENT
(Z SCORE)
+1
0
-1
Lo Dep
Hi Dep
Lo
Hi
SCHED
Lo
Hi Dep
Lo Dep
Lo
Hi
SCHED
Hi
CLASS ORIENTATION
D

FIGURE 2

INTERACTION ON OBJECTIVE SCORE

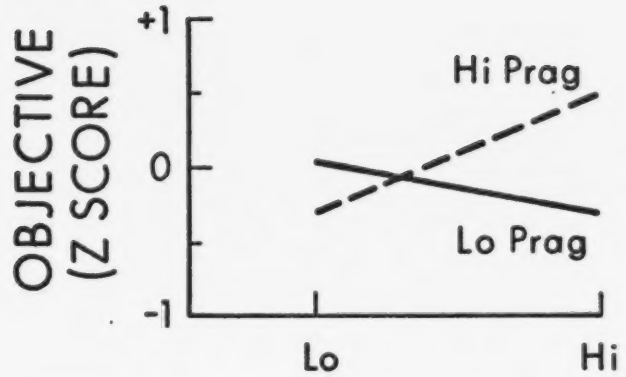
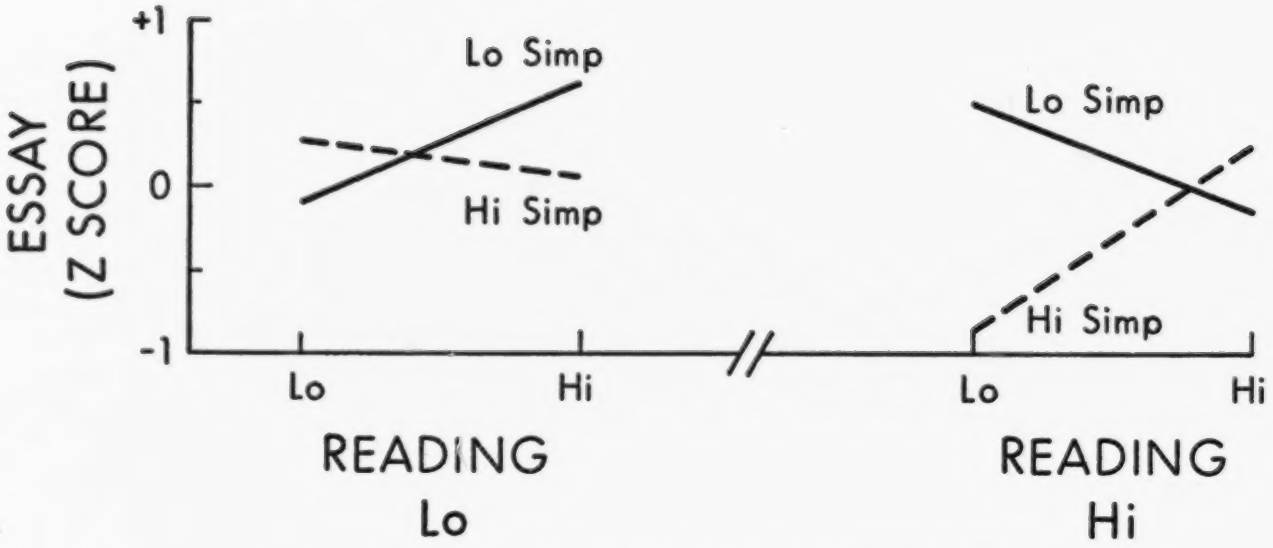
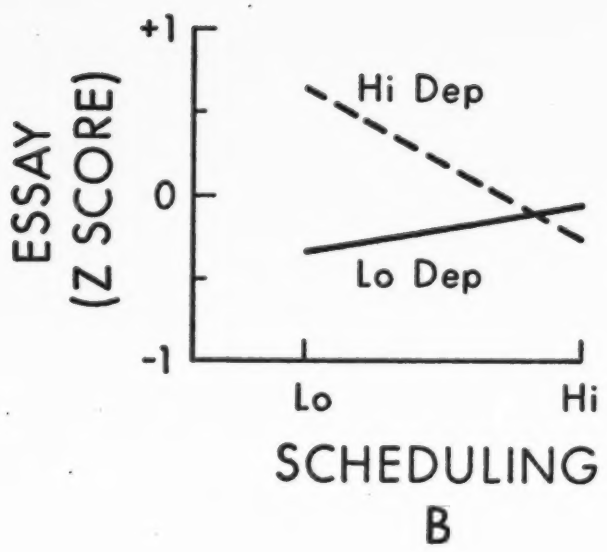

OBJECTIVE
(Z SCORE)
+1
0
-1
Hi Prag
Lo Prag
Lo
Hi
FACT-ROTE

FIGURE 3

INTERACTIONS ON ESSAY SCORE


ESSAY
(Z SCORE)
+1
0
-1
Lo Simp
Hi Simp
Lo
Hi
READING
Lo
Lo Simp
Hi Simp
Lo
Hi
READING
Hi
ACADEMIC INTEREST
A


ESSAY
(Z SCORE)
+1
0
-1
Hi Dep
Lo Dep
Lo
Hi
SCHEDULING
B

Appendices

MANOVA 1

PRAGMATISM, CLASS ORIENTATION AND SCHEDULING: F-RATIOS AND CELL MEANS

	Ach.	Obj.	Ess.	Disc.
A. Pragmatism	.25	3.95*	1.20	2.00
B. Class Orient	.20	.00	.02	.07
C. Sched.	.04	.53	.96	.57
A.B.	6.59*	.06	.09	2.16
A.C.	.02	.01	.85	.28
B.C.	.80	1.14	.26	.77
A.B.C.	.66	1.58	1.37	1.34

df 1, 52 for univariate effects; 3, 50 for multivariate effects

*P < .05

N	Cell	Ach.	Obj.	Ess.
12	111	.37	-.04	.23
4	112	.36	-.49	.13
7	121	-.47	-.56	.53
4	122	-.51	.32	-.69
10	211	-.19	.18	-.08
7	212	-.54	.38	-.27
6	221	-.17	.19	-.19
10	222	.32	.40	-.11

MANOVA 2

PRAGMATISM, ACADEMIC INTEREST AND FACT-ROTE STRATEGY: F-RATIOS AND CELL MEANS

	Ach.	Obj.	Ess.	Disc.
A. Prabmatism	.23	4.54*	1.35	2.01
B. Ac. Int.	.02	.51	2.13	.86
C. Fact-rote	.00	3.07	5.75*	2.80*
A.B.	1.87	.07	.00	.64
A.C.	.02	4.26*	.48	1.51
B.C.	1.03	3.47	.12	1.55
A.B.C.	.73	.21	2.29	1.07

d.f. 1, 52 for univariate effects; 3, 50 for multivariate effects

*P < .05

N	Cell	Ach.	Obj.	Ess.
9	111	.24	-.17	.10
4	112	.25	-.65	.94
8	121	-.17	-.15	-.08
6	122	-.21	.01	.05
7	211	-.54	.03	-.19
10	212	-.04	.39	.20
5	221	.37	-.65	-1.27
11	222	-.11	.80	.08

MANOVA 3

CLASS ORIENTATION, WIDE READING AND FACTROTE STRATEGY: F-RATIOS AND CELL MEANS

	Ach.	Obj.	Ess.	Disc.
A. Class Orient.	.24	.02	.05	.10
B. Wide Read	4.71*	2.40	.19	2.54
C. Fact-rote	.08	4.09*	3.66	2.46
A.B.	.30	.30	1.04	.52
A.C.	.20	1.08	.15	.44
B.C.	.14	.78	1.52	.77
A.B.C.	6.85**	.16	.00	2.31

d.f. 1, 52 for univariate effects; 3, 50 for multivariate effects

*P < .05;

**P=.01

N	Cell	Ach.	Obj.	Ess.
12	111	-.35	-.28	-.16
6	112	.15	.33	.84
7	121	.70	-.25	-.32
8	122	-.17	.63	-.02
4	211	-.10	-.10	-.67
6	212	-.86	-.29	.21
6	221	-.23	-.04	-.09
11	222	.35	.44	.07

MANOVA 4

CLASS ORIFNTATION, SCHEDULING AND DEPENDENCE: F-RATIOS AND CELL MEANS

	Ach.	Obj.	Ess.	Disc.
A. Class Orient.	.25	.02	.06	.11
B. Sched.	.01	1.50	1.60	1.12
C. Dep.	2.64	7.98**	3.62	4.43**
A.B.	1.78	2.29	.10	1.33
A.C.	.43	2.41	.20	1.07
B.C.	.52	3.35	5.28*	3.29*
A.B.C.	7.94**	.18	.176	3.18

d.f. 1, 52 for univariate effects; 3, 50 for multivariate effects.

*P < .05
**P < .01

N	Cell	Ach.	Obj.	Ess.
13	111	.19	-.20	-.34
9	112	.01	.43	.71
5	121	.43	-.85	.36
6	122	-.75	.82	-.53
5	211	.39	-.17	-.34
8	212	-.78	-.24	.54
6	221	-.32	.04	-.50
8	222	.38	.63	-.10

MANOVA 5

ACADEMIC INTEREST, SIMPLIFYING AND RELATING STRATEGIES: F-RATIOS AND CELL MEANS

	Ach.	Obj.	Ess.	Disc.
A. Ac. Int.	.02	.34	1.94	.77
B. Simp.	5.73*	.82	.34	2.32
C. Relat.	3.78	.44	1.40	1.74
A.B.	1.30	1.70	.03	1.04
A.C.	.17	.62	.30	.38
B.C.	1.54	.24	.42	.68
A.B.C.	3.27	.57	5.32*	2.93*

d.f. 1, 52 for univariate effects; 3, 50 for multivariate effects.

*P < .05

N	Cell	Ach.	Obj.	Ess.
10	111	.22	-.14	-.01
5	112	-.26	.36	.60
7	121	-.67	-.23	.28
8	122	.34	.16	.05
3	211	-.15	.20	.48
11	212	.60	-.21	-.19
8	221	-.70	.23	-.90
8	222	-.32	.53	.25

MANOVA 6

ACHIEVEMENT-ORGANIZATION, FACT-ROTE STRATEGY AND ACADEMIC NEUROTICISM:

F-RATIOS AND CELL MEANS

	Ach.	Obj.	Ess.	Disc.
A. Achiev.	.34	1.12	3.27	1.53
B. Fact-rote	.01	3.80	5.73*	3.02*
C. Ac. Neur.	9.09**	1.55	.06	3.59*
A.B.	5.05*	.00	.09	1.64
A.C.	.65	.13	1.08	.61
B.C.	.08	.00	1.24	.43
A.B.C.	.61	.38	.04	.31

d.f. 1, 52 for univariate effects; 3, 50 for multivariate effects.

*P < .05

**P < .01

N	Cell	Ach.	Obj.	Ess.
13	111	.34	-.06	-.19
6	112	-.00	-.62	.22
2	121	.50	.37	.83
10	122	-.49	.22	.63
8	211	-.32	-.13	-.68
2	212	-1.50	-.11	-.42
8	221	.62	.57	.29
11	222	-.27	.24	-.31